

Serial No. 09/529,957
Docket : SPF 0004 PA/41105.14

Amendments to the Claims:

This listing of claims will replace all prior versions, and lists, of claims in the application:

1. (Previously presented) A method for contactless or touch-free measurements of a tool or accessories by means of at least one imaging area means and calculation indicating the position and/or orientation of the tool making use of image points on the imaging area means, based on the image points having predetermined mutual positions provided on the tool, imaged onto the imaging area means, and optics presenting the image points on the tool on the imaging area means, the image points being at least three visible within the field of view of the imaging area means at least one being distinctly identifiable, characterized by, in order to measure the position and/or orientation of the tool, providing a number of measuring elements on the tool, each measuring element having a size large enough for making a reconstruction of its form and calculation of at least one image point on the tool related to the measuring element even though a part of it happens to be obscured.
2. (Original) Method according to claim 1, characterized in that at least some of the measuring elements, called lined measuring elements, are positioned on at least one row; and that for each row at least one 3D line going through the lined measuring elements for the row in question is determined.
3. (Previously presented) Method according to claim 1, characterized in that consecutive measurements of the measuring elements are provided, each measurement resulting in calculation of the 3D position and/or 3D orientation of the tool, and further calculations are performed to calculate the 3D movements of the tool from calculation to calculation and thereby to calculate at least one type of movement of the tool, such as shift, or rotation.

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Serial No. 09/529,957
Docket : SPF 0004 PA/41105.14

4. (Previously presented) Method according to claim 1, characterized in that most of the measuring elements are markers having the same shape, for instance circular, and that at least one of the markers has a shape different from the others, clearly distinguishable in the imaging area means, each said differently shaped marker having a predetermined known position on the tool and determining a reference point for determining shift position, and that a point or points on each marker are calculated to be used as the measuring point or points representing the marker.

5. (Previously presented) Method according to claim 4, characterized in that, said markers are arranged in plurality of rows and that in order to have a uniquely determined position for each differently shaped marker, the differently shaped markers having relation to different rows have a different order and/or different configurations.

6. (Previously presented) Method according to claim 1, characterized in that for each measuring element or marker its point of balance is detected and is used as a point representing the measured measuring element.

7. (Previously presented) Method according to claim 3, characterized in that at least two rows of markers are provided on the tool, and that a line going through each row and/or the position of at least one measuring element point on each row are determined.

8. (Previously presented) Method according to claim 7, characterized in that the rows of markers are parallel, the rows being either horizontal or vertical.

9. (Previously presented) Method according to claim 7, characterized in that row of the tool is derived by combining the information regarding at least two of the rows.

10. (Previously presented) Device for contactless or touch-free measurement of a tool by means

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Serial No. 09/529,957
Docket : SPF 0004 PA/41105.14

of imaging area means and processing means making calculations based on image point on the tool, imaged onto the imaging area means, and optics presenting the image of the image points on the tool on the imaging area means, the processing means being adapted to calculate the momentary position and/or orientation along at least one axis of the tool making use of the image points, characterized by a number of measuring elements and/or markers having predetermined mutual positions and being provided on the tool, each measuring element and/or marker comprising at least one measuring point, and at least one of them being identifiable; each measuring element and/or marker to be used as position and/or orientation indicating means having a size making it restorable by the processing means even if a part of it on the tool is obscured for the image area means.

11. (Previously presented) Device according to claim 10, characterized in that least some of the measuring elements and/or markers, called lined measuring elements, are positioned on at least one row; and that for each row the processing means determines at least one 3D line going through the lined measuring elements for the row in question and/or the equation of at least one line going through the measuring element or markers provided in the same row.

12. (Previously presented) Device according to claim 10, characterized in that there are at least two rows of measuring elements or markers; and that the processing means is adapted to make calculations of a line through each row and/or the position of at least one measuring element or marker on each row.

13. (Original) Device accordingly to claim 12, characterized in that the rows are parallel to each other, either horizontally or vertically.

14. (Original) Device according to claim 12, characterized in that the rows of markers extend along a line going from one end side of the tool to the other and are angled in relation to each

Serial No. 09/529,957
Docket : SPF 0004 PA/41105.14

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other.

15. (Previously presented) Device accordingly to claim 10, characterized in that the processing means is adapted to make consecutive measurements to the measuring elements, each measurement resulting in the calculation of at least a line of the tool surface in space, and the processing means is adapted to calculate movements of the tool in space between calculations and thereby to calculate at least one type of movement of the tool, such as shift, or rotation.

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16. (Previously presented) Device according to claim 10, characterized in that at least most of the markers on the tool have the same shape, for instance circular, and that at least one marker is provided having a shape different from the others, clearly distinguishable in the imaging area(s), each said differently shaped marker having a predetermined known position on the tool and in relation to a predetermined constellation of the others.

17. (Previously presented) Device according to claim 16, characterized in that most of the measuring elements are positioned in a plurality of rows, and that, in order to have a uniquely determinable position for each differently shaped marker, the markers having positions related to different rows have a different order and/or different configurations.

18. (Previously presented) Device according to claim 10, characterized in that each measuring element provided in a row of measuring elements used for the measurement is a part of a marker having a two-dimensional shape.

19. (Previously presented) Device according to claim 10, characterized in that the processing means detects the point of balance in a marker and uses it as one of the measuring points.

20. (Previously presented) Device according to claim 10, characterized in that the processing

Serial No. 09/529,957
Docket : SPF 0004 PA/41105.14

means calculates shift of the tool by detecting different spatial positions of the differently shaped marker or markers in the consecutively made measurements.

21. (Previously presented) Device according to claim 10, characterized in that the markers are reflective and provided on a dull background, and by lighting units illuminating the markers at least during the imaging of the imaging areas.